

# PATENT SPECIFICATION

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## (54) METHOD AND APPARATUS FOR MAKING A STAMPED RIB IN SHEET METAL

(71) We, JEAN FRANÇON, of rue de la Véronnière, 42400 Saint-Chamond, Loire, France, and FRANCIS FRANÇON, of 11b rue Ennemond Richard, 42400 Saint-Chamond, Loire, France, both French citizens, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to a method of making a stamped rib in sheet metal and to apparatus for carrying out the method.

According to one aspect of the present invention, there is provided a method of making a stamped rib in sheet metal, comprising forming the rib in a sheet of metal between complementary male and female die members by closing and pressing the die about said sheet, the die embracing at least one edge of said sheet whilst producing said rib, which does not extend to said at least one said edge, excess material produced between said at least one edge and the adjacent edge of said rib during formation of the rib being accommodated in spaces between the die members so that the metal flows to form ridges in said sheet between said at least one edge and the adjacent end of said rib.

According to another aspect of the present invention, there is provided an apparatus for making a stamped rib in sheet metal according to the method as claimed in claim 1, comprising complementary male and female die members so shaped as to produce between them a stamped rib in a sheet of metal whilst embracing at least one edge of said sheet during formation of said rib, the rib not extending to said at least one edge, the die members having provision to accommodate excess material produced by flow of metal between said at least one edge and the adjacent edge of said rib during formation of said rib, thereby to provide ridges in said

sheet between said at least one edge and the adjacent end of said rib.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 is a perspective view of part of a known ribbed panel or sheet,

Figure 2 is a perspective view of part of a ribbed panel or sheet which has been formed by the present method,

Figure 3 is a plan view of part of a ribbed panel or sheet which has been formed by the present method,

Figure 4 is a sectional view taken along the line 4-4 of Figure 3,

Figure 5 is a diagrammatic sectional view of part of a male die or punch for use in the present method,

Figure 6 is a diagrammatic sectional view of part of an associated female die,

Figure 7 is a diagrammatic sectional view showing the male and female dies after an operating step,

Figure 8 is a cross-sectional view taken along the line 8-8 of Figure 7,

Figure 9 is a view similar to Figure 2 and showing a ribbed panel or sheet which has been formed by a modified form of apparatus,

Figure 10 is a schematic plan view of a portion of the panel in which a rib has been formed, the positioning of rams for operating the dies having been shown diagrammatically,

Figures 11, 12 and 13 are diagrammatic cross-sectional views illustrating three different phases of operation of the dies,

Figure 14 is a longitudinal sectional view taken along the line 14-14 of Figure 11,

Figure 15 is a diagrammatic cross-sectional view illustrating a modified form of apparatus for operation of the dies, and

Figure 16 is a view similar to Figure 10 but

shows the positioning of rams for operating the dies of the apparatus shown in Figure 15.

Referring firstly to Figure 1, a panel P is shown which has been produced in accordance with a known method where the ribs P1 have been formed by folding in a press so that they extend to the edges of the panel P. Where such panels are utilised as, for example, walls of containers, vans etc., the ribs are open-ended and form apertures which are capable of receiving various kinds of things such as water, snow or dust. These things may penetrate the panels and, in the course of time, the material of the panels may deteriorate as a result.

The ribbed panel 1 shown by way of example in Figure 2 as a product of the present method is formed with ribs 1a connected to a plane surface of the panel 1 by a sloping face 1b. The ribs 1a do not extend up to the edge of the panel 1.

The panel 1 is produced by stamping and, in order to recover the metal which has flowed during the operation involved in forming the ribs, and in order to prevent the metal from spreading over the plane face of the panel, the metal has to be accommodated by forming a plurality of folds or ridges 1c which commence on the end sloping face 1b of each rib 1a and extend up to the edge of the panel 1.

The number and size of the ridges 1c by each rib 1a are determined by the dimensions of that rib 1a; in other words, the amount of metal forming the ridges 1c is substantially the same as the amount of metal required to complete the rib 1a had it extended right to the edge of the panel.

As can be seen in Figure 3 (which shows a panel 2, with ridges 2a and a rib 2b), the ridges 2a enable a dimensional value B which is a line crossing the plane surface at the edge of the panel 2 to be equal to a dimensional value A which is a line crossing the rib 2b.

As shown in Figure 4, when the ridges 3a of the ribs 3b terminate at the edge of a panel 3, the ends 3c of the ridges 3a are rounded over the edge of the panel 3.

Figures 5 to 8 illustrate apparatus which can be incorporated in conventional folding presses to produce the panels illustrated in Figures 2 to 4.

Figure 5 shows a male die 6 and Figure 6 shows a complementary female die 5. The female die 5 is formed with a groove 5a for forming the rib in the panel, from which groove 5a a slope 5b leads towards what is to form the edge of the panel. Longitudinally extending triangular projections 5c are provided on the slope 5b, these projections being for forming the ridges at the end of the rib.

An extension piece 5d with a concave

portion 5e may be attached to the end of the female die to produce the rounded portion 3c (Figure 4).

The die 6 has a projection 6a, which is complementary to the cavity 5a of the female die 5, to form the rib in the panel, a slope 6b being formed with triangular recesses 6c, which are complementary to the projections 5c of the female die. The die terminates in a rounded portion 6d which is complementary to the concave portion 5e of the female die.

In order to permit the metal to flow during cold working thereof without spreading to where it is not required, it is necessary to hold the panel firmly on either side of the rib. For this purpose, there are provided adjustable pressure plates 7 held on the die 6 by screws 8 or similar means. The plates 7 are urged by resilient means 9 away from the main body of the die 6 to clamp the panel; the resilient means 9 may be in the form of washer springs as shown or may be coil springs or other resilient means.

The ribs thus produced may have two closed ends or a single one, in accordance with requirements. The ridges 1c, 2a may have any desired cross-sectional shape.

It will be appreciated that when the panels or other sections are assembled by interconnection and with further elements to produce an enclosed volume such as a van or container, there will be no apertures at the ends of the panels, thereby preventing any soiling or deterioration due to natural environmental elements, as would be the case if the ribs were to be open as conventionally.

Figure 9, which is similar to Figure 2, shows a panel 10 having ribs 10a connected to the general plane of the panel 10 by respective sloping faces 10b.

It will be recalled that in order to recover the metal which has flowed whilst forming the closed ribs or ribs which do not extend as far as the edge of the panel, it is necessary to form a pre-determined number of folds or ridges 10c commencing at the end of the ribs and terminating at the edge of the panel. According to Figure 9, however, the folds or ridges are formed either separately or in groups; in the example illustrated, the ridges 10c are four in number and they are produced in pairs, viz. firstly the two central ridges and then the two outer ridges.

Figure 10 shows a portion of the panel 10 with a diagrammatic representation of an assembly comprising male and female dies E and also rams V for operating them. This assembly is illustrated in more detail in Figures 11 to 14, which show a female die 11 with longitudinal grooves 11a in which the ridges 10c are formed, each groove having sloping parallel end channels 11b (Figure 14) for forming the ridges 10c.

A die-carrying member 12 has fast there-with longitudinal projections 12a to form the ridges 10c, each projection 12a terminating in sloping end punches or projections 12b to form the two inner ridges 10c of a rib 10a, these sloping projections 12b being complementary to the grooves 11b of the female die.

A member 13 is secured to the member 12, the member 13 housing cylinders 13a in which double or single acting pistons 14 are displaceably mounted, these pistons each being joined to two punches 15, which extend through apertures 12c in the member 12. The punches 15 are located in alignment with two of the channels 11b in the female die 11 to form the outer ridges 10b of a rib 10a.

The drawings actually illustrate that the pistons 14 are of the single-acting type, which are acted upon by a fluid introduced into the cylinders 13a through ports 15a formed in piston rods 15b. Return movement of the pistons is provided by resilient means such as the coil compression springs 16 shown.

Referring to Figure 11, to form a rib with its end ridges, the die-carrying member 12 is initially spaced from the female die 11 and the mobile punches 15 are retracted into the member 12. The panel 10 is then placed in position on the female die.

As shown in Figure 12, the die-carrying member 12 is then lowered into pressure contact with the female die 11 between which the panel 10 is disposed. This action forms the rib 10a and the inner two ridges 10c. It will be appreciated that pressure plates such as the plates 7 shown in Figures 5 to 8 may be provided but they are not essential, since the force to be applied is in the present embodiment less considerable.

As shown in Figure 13, fluid is then pumped into the cylinders 13a whilst maintaining the pressure on the female die and this causes the punches 15 to penetrate the remaining channels 11b of the female die thereby to form the two outer ridges 10b of the rib.

When all of the ridges 10b have been formed, pressure of the die-carrying member 12 is relieved and so is also pressure on the pistons 14, which are retracted into the cylinder 13a by the springs 16.

Figures 15 and 16 show a further embodiment in which four rams 17 are provided, one for each punch 15. It will be appreciated that means other than the piston and cylinder arrangements described may be provided to actuate the punches. For example, the punches may be connected to wedge or ramp systems or alternatively to devices having eccentric arrangements to actuate the punches.

#### WHAT WE CLAIM IS:-

1. A method of making a stamped rib in sheet metal, comprising forming the rib in a sheet of metal between complementary male and female die members by closing and pressing the die about said sheet, the die embracing at least one edge of said sheet whilst producing said rib, which does not extend to said at least one said edge, excess material produced between said at least one edge and the adjacent edge of said rib during formation of the rib being accommodated in spaces between the die members so that the metal flows to form ridges in said sheet between said at least one edge and the adjacent end of said rib.
2. A method as claimed in claim 1, wherein ends of said ridges are rounded over said at least one edge.
3. A method as claimed in claim 1 or 2, wherein said ridges are provided by complementary recesses and projections on the respective die members.
4. A method as claimed in Claim 1, 2 or 3, wherein the metal sheet is held by pressure plates either side of said rib during formation thereof to permit the metal to flow during cold working thereof without spreading to where it is not required.
5. A method as claimed in any preceding claim, wherein said rib is made with a sloping face at its end that is adjacent said at least one edge of said sheet, said ridges commencing on said sloping face and extending to said at least one edge.
6. A method as claimed in any one of the preceding claims, wherein said ridges are formed either separately or in groups.
7. A method as claimed in claim 6, wherein at least one of said ridges is formed by a punch, which is fixed to one of said die members, and at least one other of said ridges is subsequently formed by a punch, which is movable relatively to this die member.
8. A method of making a stamped rib in sheet metal, substantially as hereinbefore described with reference to any of the embodiments shown in Figures 2 to 16 of the accompanying drawings.
9. A stamped rib in sheet metal as produced by the method of any preceding claim.
10. An apparatus for making a stamped rib in sheet metal according to the method

- as claimed in claim 1, comprising complementary male and female die members so shaped as to produce between them a stamped rib in a sheet of metal whilst embracing at least one edge of said sheet during formation of said rib, the rib not extending to said at least one edge, the die members having provision to accomodate excess material produced by flow of metal between said at least one edge and the adjacent edge of said rib during formation of said rib, thereby to provide ridges in said sheet between said at least one edge and the adjacent end of said rib.
11. An apparatus as claimed in claim 10, wherein said die members are shaped to provide a sloping face on said rib at its end that will be adjacent said at least one edge of said sheet with said ridges commencing on said sloping face and extending to said at least one edge.
12. An apparatus as claimed in claim 10 or 11, wherein one of said die members has a plurality of projections and the other of said die members has corresponding recesses, between which projections and recesses said ridges are to be produced.
13. An apparatus as claimed in claim 10, 11 or 12, wherein said die members have complementary rounded portions to cause said ridges to be rounded over said at least one edge.
14. An apparatus as claimed in any one of claims 10 to 13, wherein adjustable pressure plates are provided on one of said die members to clamp said sheet to permit the metal of the sheet to flow during cold working thereof without spreading to where it is not required.
15. An apparatus as claimed in claim 14, wherein said pressure plates are resiliently mounted in the die member.
16. An apparatus as claimed in any one of claims 10 to 15 and being arranged to produce said ridges either separately or in groups.
17. An apparatus as claimed in claim 16, wherein a punch, which is fixed to one of said die members, is provided to form at least one of said ridges, and a further punch, which is movable relatively to this die member, is provided to form at least one other of said ridges.
18. An apparatus as claimed in claim 17, wherein said further punch is movable by means of a piston, a wedge or ramp system or by an eccentric arrangement.
19. An apparatus for making a stamped rib in sheet metal according to the method as claimed in claim 1, substantially as hereinbefore described with reference to Figures 5 to 8, or Figures 10 to 14, or Figures 15 and 16 of the accompanying drawings.

HASELTINE, LAKE & CO.,  
Chartered Patent Agents,  
Hazlitt House,  
28 Southampton Buildings,  
Chancery Lane,  
London, WC2A 1AT.  
- also -  
Temple Gate House,  
Temple Gate,  
Bristol, BS1 6PT.  
- and -  
9 Park Square,  
Leeds, LS1 2LH,  
Yorks.  
Agents for the Applicants.

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                         Sheet 1

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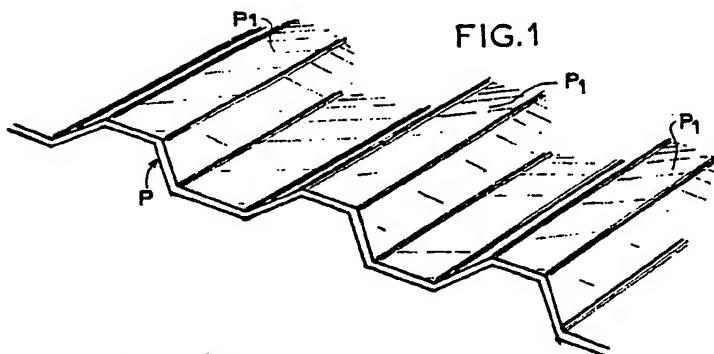


FIG.1

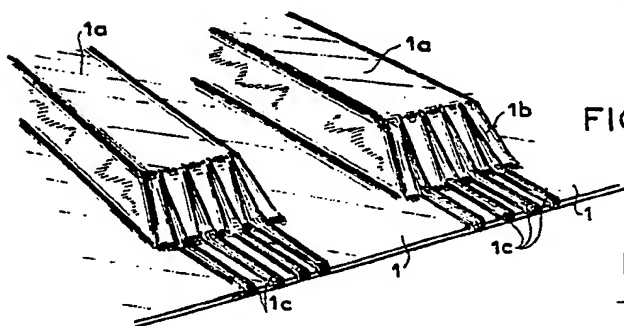


FIG.2

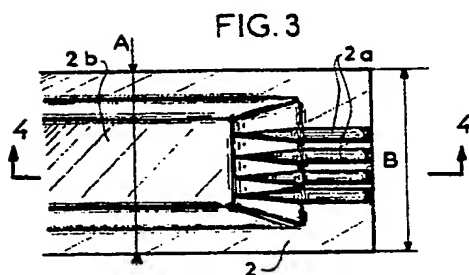


FIG. 3

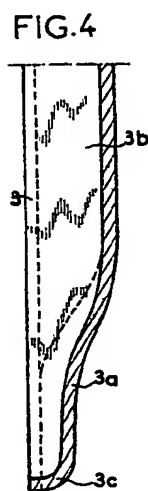


FIG.4

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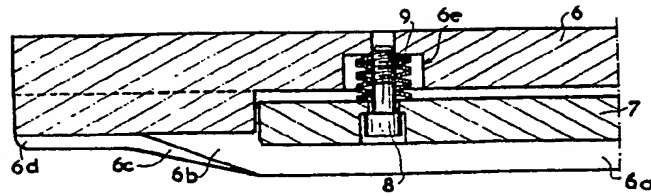


FIG. 5

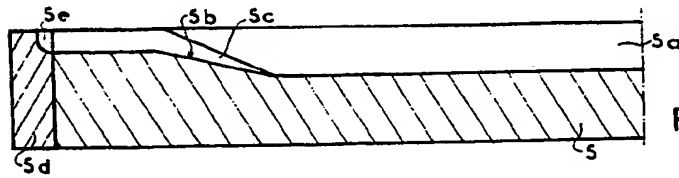


FIG. 6

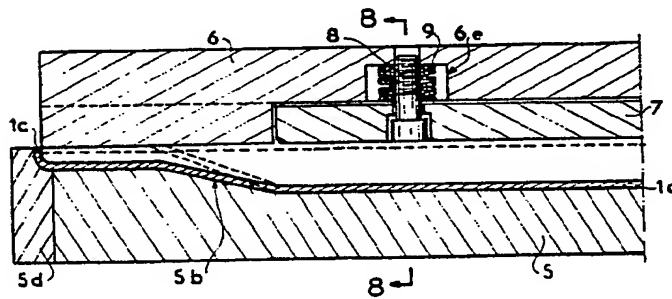


FIG. 7

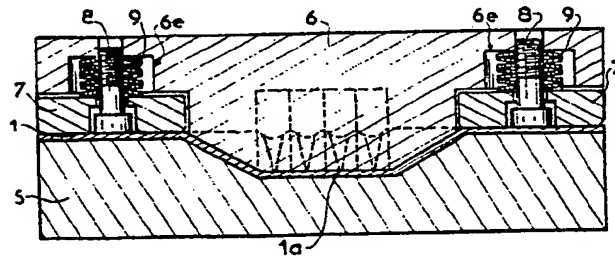


FIG. 8

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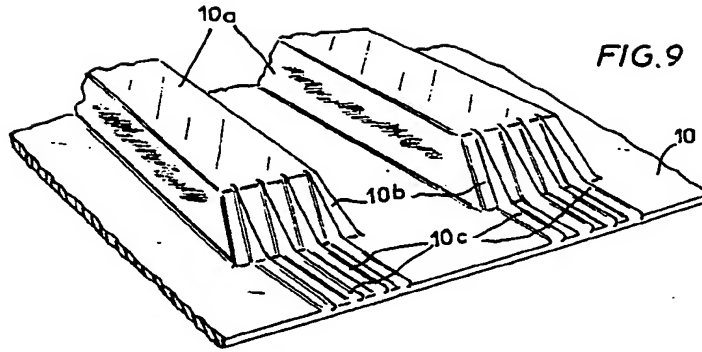


FIG. 9

FIG. 10

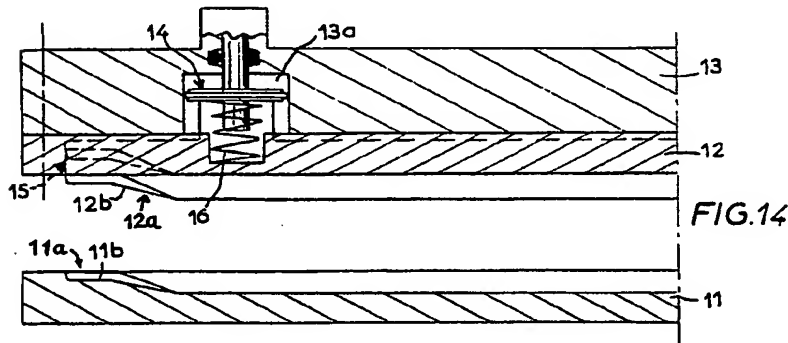
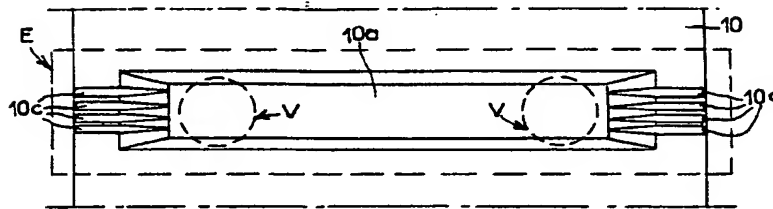


FIG. 14

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